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THE LIFE AND SCIENTIFIC WORK
OF
ARNOLD GUYOT,
Corresponding Member American Geographical Society.

BY

WILLIAM LIBBEY, Jr.,

Fellow American Geographical Society.

The greatest charm of an almost perfect life is the simplicity and naturalness of its grandeur. The heroes of the world have always been those who have ruled without seeming to, and its soldiers, its statesmen, its philosophers, have succeeded in proportion as they have made themselves the instruments through which nature and its laws could operate with the least obstruction.

The works of nature and art please or displease to the exact extent to which they satisfy some longing of the human soul. How often do the simplest and easiest lines fulfill this demand, when the forced and unnatural but grate upon our feelings and destroy the charm which sympathy sought but did not find! And is it strange that God's noblest work should so attract us when it approaches the ideal, so seldom realized, but still so real and possible, that men, no matter how much they may have striven and failed, still rejoice in its attainment by some more favored brother, as a proof that humanity is still advancing; and who is not conscious of greater strength from the encouragement obtained from the example thus set!

Such advances are marked by the stepping-stones along which the world moves on to better things; they are the proof of the existence of a higher faculty, a nobler power.

Such was the life of Arnold Guyot—simple in its grandeur and grand because of its simplicity and fullness. He seemed to breathe the purer air of the mountains he loved, and the nature that he so fondly studied rewarded him by revealing to him the secrets which made him great in the eyes of his fellows.

A life-long friend writes of him :

"My relations with this dear friend, who will ever be regretted by all who knew him, commenced at the college at Neuchâtel when he was fourteen years of age. He was then full of devoted affection for his mother and sisters, a conscientious and zealous worker, seeking and loving the truth, and exerting every energy in its pursuit ; and so he continued through life in all the paths to which Providence guided him. His career was well filled and happy. God always gave him honorable work to accomplish, and crowned his life with the respect and esteem of all who knew him, and the regard of men of science, among whom he took a place as distinguished as it was well merited."

He was born near the lovely village of Neuchâtel, Switzerland, on September 28, 1807.

In 1821 he entered the College of the City of Neuchâtel, and, having joined the second class, he passed through the first, where he obtained half the prizes of the class. Two years more took him through the course of belles-lettres and philosophy, when he graduated at the age of eighteen.

At fifteen he had already begun to give lessons in Greek, and always remembered the pride and pleasure he felt in receiving a number of gold pieces, his first independent earnings.

From this time to the end of his life he was more or less an instructor of youth. Having determined to continue his studies somewhat later, in the German University, he thought it best to devote the following year to the acquisition of the language, in Germany. With this object in view, he found a temporary abode in the house of a country pastor in the rural village of Metzingen, in Wurtemberg, not far from Stuttgart. As he could not speak a word of German, and the good pastor did not understand French, they were at first obliged to communicate in Latin. Here he remained three months, when a feeling of homesickness prompted him to pay a visit to a sister who was staying with the Braun family at Carlsruhe. He was invited to become a member of this happy household, and he gladly accepted the proposal which enabled him to attend the Polytechnic School as a free student for some months. It was during this sojourn at Carlsruhe that he made the acquaintance of Alexander Braun, which ripened into an intimacy almost like that of a brother, and continued unbroken till the death of Braun in 1877.

In the pleasant and inspiring company of Braun, Agassiz and other friends, the tastes of Guyot for natural history were fostered, and here he began his first collection of insects and land and fresh-water shells. After six months passed in this charming home, he repaired to Stuttgart and entered the Gymnasium, which had throughout all Germany a high reputation for thoroughness in classical studies. Here he enjoyed the instruction of such men as the Klaibers, and other reputed classical teachers.

At the end of another six months he returned to Neuchâtel, having so thoroughly mastered the language that he was often mistaken for a German. He now entered upon a course of study for the ministry, which he pursued for two years under the direction of the pastors of Neuchâtel.

After this course of study was finished, he went from Neuchâtel to Berlin, in 1829, to pursue the same theological studies under Neander, Schleirmacher and others. Here he lived for five happy years in the family of Mr. Muller, a Privy Counsellor of Frederic William III., where he was received as a son, and his associations were of a delightful nature, as the social connections of the family were of the most distinguished order.

When a student of Berlin, he was in the habit of attending, on Saturday afternoons, the pleasant re-unions of Neander, where some ten or twelve students were invited. weekly for the discussion of topics in which they were particularly interested. Similar little gatherings were held, on other days, at the houses of Hengstenberg, Steffens and other professors, in which Guyot took part.

At the end of a year he was much attracted by the natural sciences, and thus a new field of study, congenial to his tastes, seemed to open before him ; and he resolved to give up theology, not from any distaste for it, but from the fear of entering upon the "high office of the ministry with a divided mind."

He was honored with the friendship of Professors Ritter, Steffens, Hoffman and Dove, and he derived great benefit from their wise counsels.

With his scientific studies he was careful to pursue simultaneously such branches as would give breadth and culture to his mind.

He listened to the philosophical courses of Hegel, and after his death, to those of his distinguished pupil Henning, and others. But the most interesting and suggestive courses of philosophy were those of Steffens, especially on psychology and the philosophy of nature.

The courses of Böckh on philology and Grecian archæology were also attended, and here Guyot caught a first glimpse of Humboldt, the gray-haired savant, who sat among the students day after day taking notes of the lectures.

Not long after this, young Guyot was requested by Humboldt to translate and prepare a notice of Bäer and Maedler's large map of the moon—a work in which Humboldt was much interested.

In 1835 he took his degree of Ph.D., receiving his diploma with the highest honor, "summa cum laude." His dissertation was on "The Natural Classification of Lakes," and was dedicated to Humboldt and Ritter, with their permission. It was written in Latin, according to the requirements of the University, and his series of thesis was defended in the same language, in the great Hall of the University, the Dean of the philosophical faculty presiding.

The students at this time resolved to present to Professor Ritter a portrait of himself by a celebrated artist, as a mark of their respect and gratitude. A committee of three was appointed, and Guyot, as chairman, was deputed to make the address.

After obtaining his degree in May, the month of June found him in Paris ready to enter upon his new sphere of duty as tutor to the sons of the Count de Pourtalès, and he started at once with the family for Les Eaux Bonnes, in the highest part of the central Pyrenees.

Here, with his young charges, he ascended some of the highest peaks of the Pyrenees and explored the intervening valleys, bringing back quite a collection of the mountain flora. In one excursion he crossed the Pyrenees by one of the highest passes, the Port d'Espagne, into Spain, to get a glimpse of the southern slope of the chain. The wild and picturesque valley of Gavarnie, the dark and gloomy valley of the Eaux Chaudes, and several others, were visited. These expeditions were doubly interesting and instructive, as they enabled him to compare the physical structure of these mountains and their flora with those of the Alps.

At the end of the season, the family returned to Paris, and the young people began more serious work.

One of Guyot's principal objects at this time was to undertake a translation into French of the master-work of his friend and professor, Carl Ritter, "The Geography of Asia." Humboldt, who took much interest in this project, gave him letters of introduction to the great physicist, Arago; Brogniart, the co-laborer of Cuvier; to Klaproth, the celebrated author of the "Researches on the Geography of China"; to Eyries, the translator of Humboldt's charming book, "Views of Nature"; also to the elegant writer and erudite geographer, Baron Valkenaer, and many others.

At the house of Brogniart, where he was often invited, he became acquainted with the most eminent members of the Académie des Sciences, who met once a week under his hospitable roof.

The plan of the translation was soon relinquished, as it was found that the work had already been done, though in a very unsatisfactory manner.

The climate of Madeira was recommended for the health of Madame de Pourtalès, and the whole family set out on the journey in the Autumn of 1837.

On reaching Pisa, they established themselves for a prolonged sojourn, as the gentle invalid became too ill to proceed further. Here the time was improved in ascending mountains and investigating the physical features of the country, and the first barometrical observations of Dr. Guyot were taken from the leaning tower of Pisa. He measured the Monte Pizano and, in connection with Chevalier Antinori, determined the elevation of the observatory of Florence above Pisa and the sea. Soon after, Madame de Pourtalès died, and her parting request was that her sons should be left under the direction of Dr. Guyot, who had gained her confidence as well as their affection. He accepted the trust, and the young men remained with him many years until the completion of their education.

But for this engagement he might have become the preceptor of Prince Frederic William, only son of the present Emperor of Germany, a situation which was afterward accepted by his friend Frederic Godet, of Neuchâtel.

In 1839 the Academy of Neuchâtel was founded, with the object of giving a university course of study to the post-graduates of the college.

Dr. Guyot was appointed to one of its twelve professorships, and returned to his native town to enter upon a more enlarged field of labor. The following nine years were among the most active of his life. His chair was a double one, including Universal History, in the college; and Physical Geography and History, in the university, and he prepared thirteen distinct courses of lectures on these subjects.

In the college, he had, during three years, five lectures a week on ancient and modern history; and others, in the academy, which were mostly on the important transition epochs, such as the development of Greek culture and the Hellenization of the Orient, from the time of Alexander the Great; the great migration of the people, after the fall of the Roman Empire, and the formation of the feudal system; the origin of the European nations and languages; the crusades, the "flowering time" of the Middle Ages, and the culmination of the papal system; the Reformation.

In physical geography he had general and special courses.

In addition to these, he gave, by request, courses of public lectures, and had at the same time several hours of teaching in his own home.

His vacations were devoted to geological and physical investigations in the field, among the glaciers and Alpine boulders in connection with the researches of Agassiz, the final results of which were a complete demonstration that the law of the distribution of the Alpine boulders is identical with the laws of the arrangement of the moraines of the glaciers.

This decided the questions of the mode of the transportation of the ancient diluvial glaciers on both sides of the central Alps.

In his memoir of Agassiz, he gives the following account of his own labors in connection with those of that great scientist, and it is of considerable importance, as it contains his most notable discoveries concerning the motions of the glaciers:

" In the Spring of 1838 I had the pleasure of a visit from my dear friend Agassiz, in Paris, where I then resided. The main topic of conversation was, of course, the glaciers. He put me *au courant* of Charpentier's views, as yet imperfectly published (his book having been issued only two years later, 1840), and adding his own idea of a general glacial era, he urged me to turn my attention to these phenomena. I asked to be allowed to suspend my judgment until my own observations should justify my adhesion to so startling a theory, but promised to visit the glaciers that very Summer. I did so, and an exploring tour of six weeks in the central Alps rewarded me beyond my expectations. The glacier of the Aar, on which Agassiz began two years later (1840) his regular system of observations, taught me the law of the moraines. The glacier of the Rhône gave me the law of the more rapid advance of the centre of the glacier, and that of the formation of the crevasses, both transverse and longitudinal. The glacier of Gries showed me the laminated or ribboned structure (blue bands) of the ice deep down in the mass of the glacier, and the law of the more rapid advance of the top over the bottom. On the southern slope of Mont Blanc, the great glacier of la Brenva, with its twin rocks rising like two dark eyes from the middle of the ice (they are, indeed, called by the mountaineers the 'eyes of the glacier') made me understand that the motion of the glacier takes place by a gradual displacement of its molecules under the influence of gravity, giving it a sort of plasticity, and not by a simultaneous gliding of its whole mass, as believed by de Saussure. All these laws deducted by a first, but attentive, study of the phenomena of the glaciers were, at that time, excepting that of the moraines, new for science. They were expounded by me and illustrated by diagrams, at the meeting of the Geological Society of France, in session at Porrentruy the same Summer of 1838, and I had the great satisfaction of seeing them fully confirmed by the subsequent observations of Agassiz and others, which furnished the precise numerical data then wanting for their complete elucidation."

Professor Tyndall, in his book, "The Forms of Water," when speaking of the laminations of the glacier ice, says:

"M. Guyot threw out an exceedingly sagacious hint when he compared the veined structure to the cleavage of slate rocks." And this is all he says concerning Dr. Guyot's valuable investigations. It however shows a familiarity with Dr. Guyot's memoir on the subject, and it is inexcusable that one so shrewd as Professor Tyndall, after having read that short and clear statement of the facts, of which a summary has been given above, should persistently attribute the honor of their discovery to his countryman, Professor Forbes.

While his long vacations were reserved for the study of the phenomena of the erratic boulders, in his shorter holidays he made a thorough examination of all the slopes of the Jura within the radius of a day's excursion from his own residence. He noted the size and arrangement of the principal blocks of these foreign rocks, measured their elevation above the lake and traced the upper limit at which they occur.

His mind was at this time much occupied with history. He had at first objected to this branch of teaching, but he soon found it was a great aid to him in his other studies. Taking it up in connection with geography, he saw the intimate relation of one to the other, and was led to the philosophical conclusions which afterward became the basis of his work "Earth and Man."

He also worked out a series of original ideas on the development of universal history, which resulted in a system of "philosophy of history."

He removed in 1844 to a new house, which he shared with his colleague Agassiz, each having a separate suite of apartments. This dwelling was surrounded by beautiful gardens, and its windows looked out upon the Bernese

Alps and Mont Blanc and the intervening lake, in one direction, and the Jura mountains in another.

A desire to study the annual variation of temperature in the waters of the Swiss lakes, led him to undertake, in his hours of recreation during the college term, a series of thermometrical soundings in Lake Neuchâtel. The observations were made with six thermometers attached to a line, at every hundred feet, giving the simultaneous temperature of every layer from the top to the bottom of the lake, and repeated, at least once, during every month in the year. As an accurate knowledge of the experiments, he was led to study the topography of the bottom of the lake, and this preliminary work became more and more important, as he soon understood that it must be the basis for all investigations of the phenomena connected with the lake basin ; he found also that it offered a specially interesting side to the geologist.

The result was a handsome map of the subaqueous basin of the lakes of Neuchâtel and Morat, founded upon over 1,100 soundings and drawn by Mr. Henri de Pourtalès. The subaqueous topography was distinguished from that of the shore by its blue color.

This was the first attempt at the complete topography of a Swiss lake, and is still the only one of the description.

He was much struck in later years with the remarkable resemblance of the principal features of this small basin to those of the oceans as revealed by the soundings made for the telegraphic cables.

In October, 1847, after nursing a pupil through an attack of typhoid fever, he was brought so low by the same malady that his friends and physicians gave up all hope of his recovery. Many proofs of sympathy and affection were shown him by the students with whom he was a great favorite; numbers called every day at the house to inquire after him, and on his restoration to health, they came in a body to offer their congratulations, and to give him a serenade. After his long illness he was beginning to regain his strength, when the revolution occurred, in March, 1848, by which the University was broken up.

The citizens of Neuchâtel hoped that their political troubles would be of short duration, and they proposed to make up Dr. Guyot's entire salary if he would continue his lectures in the college and still instruct their sons.

Other tempting offers were made to him, but he declined them all, regarding them as temporary measures that would lead to no permanent settlement. He had little hope of a restoration of the old form of government, and thought if he were ever to leave his native country, this was the time.

Agassiz, who was already in America, strongly advised him to seek a home in the new country. The idea appeared, at first, altogether visionary, but many indications seemed to point in that direction. The important decision was finally made in May, and preparations for departure were at once begun. This step was taken with the full consent of his wise and loving mother, on whose counsels he had ever relied. Though 70 years of age, when it was a serious matter to be transferred to a new social sphere, so great was her affection for this devoted son, that she expressed her readiness to follow him, at the end of a year, if he thought best.

Professor Guyot reached New York early in September, and proceeded at once to Cambridge, where he was warmly welcomed by Professor Agassiz. A few days later they went to Philadelphia to attend a meeting of the Association of Science, just reorganized from the old Geological Society of earlier date. Here he met, for the first time, Professors Henry, Alexander, Baird, and others, with some of whom he was destined to become so intimately acquainted. Desiring to take a first look at the mountain systems of America, and impatient to compare them with those of Switzerland, he resolved to make a stage journey of a week across the Alleghanies to Bedford and Cumberland. As he could scarcely speak a word of English, he took his seat beside the driver day after day and quietly made his first study of the new language.

Having a letter of introduction to Dr. Charles Hodge, he stopped at Princeton on his return and caught a glimpse of the town which was later to become his home. He was kindly received by Dr. Hodge, who invited Dr. Torrey, Prof. Henry, Prof. Alexander, and others to meet him. In January, 1849, a few months after his arrival in America, Professor Guyot was asked to deliver before the Lowell Institute of Boston, a course of lectures in French, on "Comparative Physical Geography in its relation to the History of Mankind."

After the delivery of the first lecture, he was urged to publish the course in one of the newspapers, but as he had spoken simply from notes he objected to the possibility of such a scheme.

His friends, however, would take no refusal, and he was advised by them to write out the lectures, and Professor Felton, who afterward became President of Harvard College, very kindly engaged to translate them as fast as they were written. Before the week was over, the first lecture was written in French, translated into English and printed in the daily paper. The interest it awaked in the public mind was so great that this plan was pursued throughout the entire course of twelve lectures, and in six weeks they were ready for the press in book form. The same kind friends made arrangements for their publication, and in another six weeks they appeared in a volume bearing the title of "Earth and Man." It was received with great favor and the universal expression that entirely new views of the subject of physical geography and its relations to history had been presented. The effect produced in England was equally great. Half a dozen different houses republished it in London, though often in a mutilated form, and the reviews, such as the *Athenæum*, and others, were most favorable in their criticisms. Two editions were translated in Germany, and repeated requests for its publication in France were refused by the author, who desired to enlarge and expand it. In a letter of congratulation upon the appearance of "Earth and Man," Ritter wrote in large characters underscored "Excellent, excellent, excellent," and in every subsequent communication he repeated his thanks for what the author had taught him.

A mutual friend afterward told Professor Guyot that Ritter was in the habit of carrying the little volume whereever he went, calling it "his vade mecum." In this unexpected way was the foundation laid for Professor Guyot's scientific career in America, and his reputation as a profound thinker was at once established.

He was next called to an important work in connection with the Massachusetts Board of Education, which invited him to lecture in the normal schools and teachers' institutes on the true methods of geographical teaching. To this pioneer work he devoted six Summers, speaking every year to from 1,500 to 1,800 teachers of both sexes. This gave him an extended influence, and brought him in contact with the most intellectual people of the State, each invitation to these institutes being the result of a special call from the educated citizens of the town where it was held. One of his associates in this work was Professor Louis Agassiz, whose branch was that of natural science. The effect of these institute meetings on public education was such that, according to the testimonials of the school committees, the places which enjoyed this advantage were ten years in advance of others in the soundness of their methods.

The teachers were so much pleased with Professor Guyot's mode of presenting the hitherto rather dry subject of geography that they imposed upon him the duty of preparing a series of books and maps as instruments to aid them in applying and expounding his methods. Thus was the way prepared for his geographical publications, which, at a later period, became such an important addition to the list of educational works, and completely changed the character of all the text-books on this subject throughout the country. About this time, at the request of the Regents of the University of the State of New York, the State granted an appropriation for renewing the system of meteorological observations, and providing the stations with better instruments. This was to be accomplished under the joint supervision of the Board of Regents and of the Smithsonian Institution.

Professor Henry proposed to intrust the execution of the plan to Professor Guyot.

The barometers in use at the various stations were found to be very imperfect, and his first care was to arrange, with the aid of a skillful optician, a set of instruments combining the qualities which he considered desirable for such a meteorological system. He rejected all the forms in vogue, and introduced into this country the cistern barometer of Fortin, improved by Ernst, making certain modifications and additions to render it more useful in a land of such distances and such rough modes of travel. These instruments, which are now termed the Smithsonian barometers, have been adopted at the army stations as well as by the Signal Service, and are in universal use.

He prepared a report, in which he gave reasons for the distribution of the stations, connecting with it a short topographical description of the country, which was afterward republished in *Silliman's Journal.* A series of instructions for making observations was prepared by him, together with tables for their reduction.

In the Winter of 1850–51, the initiatory steps in this meteorological work were taken, not without much personal discomfort, and even real hardship and suffering on the part of Professor Guyot. Fifty barometric stations were established in various parts of the State of New York. As it was before the days of rapid transit by railroad, he was obliged to travel from point to point in the depth of Winter, over rough and sometimes almost unbroken roads in any conveyance that could be obtained.

The book called "Meteorological and Physical Tables" was first published in 1851. It was considerably enlarged in 1858 and 1859, and was increased to a volume of 600 pages in the third edition. This valuable collection has been extensively used both in this country and in Europe, and, indeed, throughout the world. A steady demand for it renders necessary a fourth edition, which has been enlarged and changed according to his written directions, and is now in press. The book received a high compliment from Sir John Herschel in his "Treatise on Meteorology."

One of Professor Guyot's great desires, even at that early date, was to arrange a system of observations to be taken simultaneously throughout the country, in connection with the telegraphic stations, so that the coming of storms might be predicted, and other phenomena of the weather noted. He placed mercurial barometers at many points, and took great pains himself to instruct observers; but on account of a lack of funds the work had to be abandoned by the Smithsonian Institution.

This plan, which really originated with him, has since been carried out by the Signal Service Bureau, which has become a very important institution, and each day issues a weather map and prognostications, which are published in the daily newspapers, and are of great benefit to commerce.

In 1854 Professor Guyot was called to the chair of Physical Geography and Geology in the College of New Jersey, and, in 1855, he removed with his family from Cambridge, Mass., to Princeton, where he found a congenial home.

When the State Normal School was founded at Trenton he was appointed Lecturer on Physical Geography and Geology, and retained the position for a number of years.

In 1861 he was also appointed Lecturer Extraordinary in the Princeton Theological Seminary, where the subject of his lectures was "The Connection of Revealed Religion and Physical and Ethnological Science."

He filled this latter appointment during the five succeeding years, and many young ministers then came under his influence. In later years numbers of them expressed their thanks for the valuable instruction received from him, which had enlarged their views and increased their usefulness. He also gave lectures in the Theological Seminary of New York, the Smithsonian and other institutions.

His vacations for more than twenty years were employed in investigating the physical structure and elevation of the Appalachian system of mountains, including the White, Green, Adirondack, Blue Ridge and Black mountains. A part of the results are embodied in two memoirs, one "On the Physical Structure of the Appalachian System of Mountains," published in *Silliman's Journal*, in 1861, and another "On the Physical Structure of the Catskill Mountains," in 1880, both with maps.

During the war, his map of the mountain district of South Carolina and Georgia was reproduced among the war maps published by the Coast Survey, and an abstract of his memoir on the Appalachian system was sent to all the officers of the army operating in that neighborhood.

Being out of health in 1871, he made a journey to California, and was much interested in the geographical and geological features of that new country. Many mountain measurements were made by him in the coast range of California. In Colorado, he took the elevation of Gray's Peak, one of the highest points of the Rocky mountains. So accustomed was he to mountain climbing that, although advanced in years, he made this long ascent with perfect ease, while younger men, who seemed full of strength and vigor, gave out long before the summit was reached.

"His last work of this kind was carried on in the Catskill mountains between 1862 and 1879, the latter date being two years after he had passed his seventieth birthday. It was a work of great difficulty on account of the pathless forests spreading over many of the summits, and the necessity in some cases of climbing to the tops of the highest trees to gain a view of the neighboring summits for triangulation. He carried his survey through with wonderful precision, discovered the law of the formation of that peculiar region, and has given an excellent map of the greater part of it."

He began the preparation of a series of wall maps and geographies for schools in 1861, and for more than nine years was more or less occupied with their publication.

There are three series of wall maps physical and political. A small common school series, a medium series, and a large series which comprises a number of maps eight feet by five.

There are also three classical wall maps of Greece, Italy, and the Roman Empire. The wall maps are thirty in number, all worked out from the most reliable sources. The maps in the school atlases, not counting the duplicates used in more than one book, number one hundred.

The geographical series consists of six volumes, from the "Introductory" to the "Grammar School Geography," with a large number of illustrations, and each with an atlas. The series terminates with a "Physical Geography," published in 1873, which has twenty-six original maps and many illustrations. These geographical works received the Medal of Progress from the World's Exhibition, held in Vienna in 1873, also the gold medal at the Exposition Universelle, at Paris, in 1878. Professor Guyot also wrote a treatise on physical geography in Johnson's "Family Atlas of the World," and, with President Barnard of Columbia College, was one of the editors-in-chief of Johnson's "Universal Cyclopædia"—a work in four large volumes, which was completed in 1877.

Three smaller publications deserve mention : An address before the American Geographical Society on the occasion of the "Humboldt Commemoration," which was printed in the journal of that Society in 1859; another address, before the same society, "On the Life and Services to Geographical Science of Carl Ritter," appeared in its journal in 1860 ; and a biographical memoir of Louis Agassiz, read before the National Academy in 1877–78, and also republished in 1883.

The crowning work of his life was the little volume which he wrote, on the eve of his departure for another world, and, as has been well said, it was "his scientific will and testament," for this comprehensive book of 136 pages contains in modest and simple words, so characteristic of the man, a statement of the interpretation of biblical cosmogony in the light of modern science as beautiful as it is valuable. He shows in a way that is irresistible that the Book of Revelation and the book of Nature are in complete harmony with one another, both giving witness of the same great and all-wise Creator.

His geographical publications have revolutionized the sentiment in this country as to the true character of geographical instruction, as anyone can see who will compare the text-books of the present day with geographies of fifteen or twenty years ago ; and it is pleasant to note that his own still hold the first place, though others have adopted his ideas, and copied his maps, often without giving him credit. Then, geography meant a collection of dry, disjointed facts, now it has become an exact science, and is anything but the superficial and fragmentary summary of the natural and political divisions of the earth.

The most substantial monument that Professor Guyot has left behind him in Princeton, as a testimonial of his love for his students, and his zeal for science, is the E. M. Museum of Geology and Archæology, which owes its origin to him.

When he took possession of his chair, this being a new department, there was no museum connected with it. To meet the urgent needs of the lecture-room, he gradually gathered together a small collection of fossils. In 1861 he took advantage of a trip to Europe to increase it by the purchase of European specimens representing the various geological ages. A large hall, hitherto used as a library. was set apart by the trustees, in 1874, for the Geological Museum. This was refitted and arranged for the purpose, and still contains the main teaching collection of the department. It was called by Dr. Guyot the "Synoptic Room," the leading feature in the arrangement of the fossils being that they should strike the eye as an open book, in which the student might read at a glance the history of creation from the dawn of life to the appearance of man, an arrangement which has since been adopted by Professor Owen, in planning the new extension of the British Museum at Kensington. A department in which Dr. Guyot was particularly interested was that of archæology, and this branch of the museum was somewhat especially developed by him, an interesting feature in it being a collection of implements from the stone and bronze age, from the Lake dwellings of Switzerland, also a model of one of these dwellings on a large scale. This collection is only rivaled by that of the Smithsonian, at Washington.

Other localities in Europe are represented, such as France and Denmark; and from America the pottery and other remains from the mound builders, and the relics of more recent date from the Indians of New Mexico and Alaska, fill an interesting portion of the museum.

A large collection of Peruvian and Mexican pottery is also to be found in this section. This department, which occupies the galleries of the above mentioned room, is enriched by the splendid series of models of the cliff ruins of the Southwest, which were made under the direction of Dr. Hayden. After the museum had been started, the State Geological Survey presented it with a series of the characteristic rocks and fossils of the State, and a special room was fitted up for the purpose of showing this collection to the best advantage. Later on, the collection of erratic boulders from Switzerland of over five thousand specimens, which had been presented by Dr. Guyot to the college some time before, was taken from the boxes which had held them for over twenty-five years, and after they had been classified under his direction, were placed in an adjoining room, where they demonstrate, when studied in connection with the maps in the room, the extension, thickness and limits of the great ice masses which covered all Switzerland in the Diluvian age. This collection, made entirely by himself, is the only one of its kind in existence, and, of course, is the only proof of the theories now generally accepted concerning the glacial epoch.

In 1878 the eastern wing of North College was set apart for the uses of the Museum, by the trustees, in addition to the other portion of the building already occupied, and this was fitted up to contain the collections for the illustration of more extended courses in palæontology, and also to provide for the lecture-room and appropriate work-rooms. The collections in this room are very complete, containing the most important vertebrate and invertebrate fossils from Europe and America, illustrating all the great geological epochs. Here are also a fine series of fossils from Colorado and Wyoming, procured by the various scientific expeditions which have gone out from the college.

The influence of the museum in guiding the tastes of the students in a scientific direction has been very marked.

A first scientific expedition sent out by the Museum in connection with the School of Science Museum, in 1877, has been followed by two others formed by the students themselves, and some of the finest specimens now on exhibition have been brought back and deposited in the museum as an evidence of the zealous spirit which was instilled by Dr. Guyot's careful training.

After a long career of useful labors Arnold Guyot went to his reward, in the seventy-seventh year of his life, on the 8th of February, 1884.

Those who have read the eloquent memoir of his lifelong friend, the lamented Agassiz, can only wish that some one could be found to perform the same loving service for him; some one of his companions who knew him throughout his whole career and could do justice to such a life.

How true of him are the opening words of that address:

"For some time past there has been among us a vacant place which cannot easily be filled. The extraordinary personal qualities of character, as well as the talents and attainments of its former occupant, render such a task indeed almost impossible."

Dr. Guyot was preëminently a teacher. His habits of study and his methods of imparting the results of his reading were clear and simple. It was easy to see in his presentations of a subject in the class-room that facts had been not only gathered, but weighed and sifted so that his students felt that they were getting a larger percentage of "wheat" than usual.

He seemed to have the faculty of interesting those who heard him as well as of instructing them, and in spite of this tendency to popularizing his subject he never allowed himself to get into the rut of merely talking to please, for after presenting a subject to the class in one lecture, at the next exercise his practice was to question the class closely upon what they had heard in the last lecture, and they were invariably asked some question which made them think out some new application of the facts and theories he had presented, so that the men who attempted to recite to him "on general principles" failed to impress the Doctor with the degree of their attainments.

He aimed to teach the mind through the eye as well as by oral instruction, for his lectures were always fully illustrated by diagrams, often prepared by his own hands, and these diagrams and maps were a good example of the way in which he met the demand for facts systematically arranged, on the part of his students ; they always contained just the facts needed, no more or no less; they were clearly expressed and printed, so that everyone in the room could see just exactly what was intended ; and every other detail which might distract the attention from the main features of the thing in hand were banished from the map as useless and worse than useless—what a contrast to some maps we know of, that are crowded full of all sorts of facts, figures and fancies, and which show nothing particularly. He aimed to teach only the broad, general principles which were well founded on facts, and these he deemed it all-important that his class should know, and all else he left outside the class-room; all that was merely speculative had no place in his lectures except in the most incidental way.

It has been well said: "The complaint has often been raised against the educated man that he is not practical." How often do we hear the cry from burdened human nature: "What is the use of all your learning, unless you can tell me what I want to know? Be useful to me or away with you! I am here, blindly groping about, and constantly damaging myself by collision with three mighty powers—the power of the invisible God, the power of my fellow-man, and the power of brute nature. Let your learning be directed to the study of these powers, so that I may know how I am to comport myself with regard to them."

Charlemagne once said: "Right action is better than knowledge; but in order to do what is right we must know what is right."

What a goal does this set before the teacher, and such was the object of his life.

How true of Dr. Guyot in this connection are the words he used concerning Agassiz: "I am sure it is not in this academy that we shall have a dissenting voice as to the immense power he has exerted in this country in spreading the taste for natural science and elevating its standard." How many leading students of nature are proud to call themselves his pupils, and gratefully acknowledge their indebtedness to his judicious training. How many, who now occupy scientific chairs in our public institutions, multiply his influence by inculcating his methods, thus rendering future success sure.

Thus he taught men to think and act for themselves. A teacher thoroughly in unison with nature and its laws, a generalizer of peerless powers, he saw clearly where others groped, and saw clearly because nothing was so small as to be beneath his notice, and no fact so mean as to be unworthy of consideration.

A friend who has known him long and intimately, gives this testimony:

"Never did man walk more gladly in the footsteps of his Master. And as he followed Him so closely he came to see the material as well as the heavenly world from His standpoint, and on the pages of 'The Open Book' he loved to recognize the handwriting of his heavenly Father. He had fully learned one of the great truths which help to sweeten life—that there are really no little things, no trifles, that a mote floating in the atmosphere is as truly a part of God's handiwork as is the giant mountain. And that also in our—as we call them—small, daily duties of life, we can as truly glorify God as we could glorify Him by a grand career. So he honored his Creator and his Master in his beautiful walk with Him all these years."

I have striven to show by what has gone before, by what endowments, by what acquisitions, and by what use of his powers he rose to such an eminence in the scientific world. And yet he never sought a position. Whenever he was prepared for a place, Providence seemed to open the way before him.

A calm and thoughtful mind, with clear intuitions of nature and its works, were the two characteristics which distinguished him in degree from other men. They gave his life unity and consistency.

We find some rare traits in him. He needed courage and tenacity for his work, and these stood him in good stead—but there was not coupled with them the craft, cunning or selfishness which so often mar an otherwise beautiful career. There was no strategem in his nature; his path led straight to his object and his movements in it were simple and direct. This directness of aim is not the conventional method. Arnold Guyot at his best, even in the height of his career of usefulness, was always a student, his forte was research.

He was not unconscious of his powers, but nevertheless his self-examination was critical and unsparing; he studied his life-work as well as his powers. His work was honest throughout, and he prepared himself honestly for it. He did not gauge his attainments to the requirements of his native home where he began his career, but aimed to distinguish himself among his fellow-students of the world. Such was the man to whom came the hour, which he made an epoch in history, and the work of the great student will endure, because founded so firmly.

To one of less abundant resources and less confidence in them the difficulties in his way would have been appalling—he brought ability, courage and devotion to the cause and he gained. An opportunity presented itself to him and seldom has an opportunity been so successfully improved. He planned well and he executed his plans. We see the grandeur of these plans in youth, we see the patient, untiring zeal by which they were accomplished, and we cannot fail to see the glorious end attained and so well deserved.

How appropriate of his career are the eloquent words of Goethe:

> " Would'st shape a noble life ? Then cast
> No backward glances towards the past ;
> And though somewhat be lost and gone,
> Yet do thou act as one new-born,
> What each day needs, that shalt thou ask,
> Each day will set its proper task ;
> Give other's work just share of praise,
> Not of thine own the merits raise,
> Beware, no fellow-man thou hate,
> And so in God's hands leave thy fate."

Doubtless there is always a tendency to over-estimation when our eyes are fixed exclusively on a single character in a cause which enlists the abilities of other eminent men, but we can all add our views to those of his scientific brethren who knew him best and were personally cognizant of his services to the world of students, and assign him a high place on the world's honor list as one who loved and served his fellow-men.

There has been other wise men as estimated by conventional standards, but none more careful or whose judgments are more respected, or more solid and enduring. There have been other men of genius and men of experience, but none whose services have been more whole-souled or more self-denying. But whatever may have been the value of his work as compared with that of his great collaborators, we knew him and loved him for what he was to us—a teacher, a leader, a friend. Whatever elements of greatness he possessed were not paraded before the world, but rather used in a more quiet way in the seclusion of his study. His principles nevertheless lighted his pathway to fame, and we, and those who come after us, will withhold no just tribute of praise, and will ever cherish the memory of him whose essential character is deserving of all admiration, and whose worth can never be forgotten.